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FLIGHT NAVIGATION PLOTTING

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Officers studying air navigation problems on their own should carry out practical map exercises. A "dummy flight" is a problem requiring the various calculations necessary on an actual flight over a given route.

The dummy flight can be a group exercise or can be worked individually. Its object may be to test the preparation of flying personnel for a forthcoming flight, or to aid in the study and thorough assimilation of new problems.

For execution of a dummy flight, the navigational aids of the actual region over which the flight will be made must be taken into consideration. Instrument corrections should be as they are in fact, for which purpose air crews should have graphs for the correction of their own aircraft instruments. When preparing a dummy flight, the amount of navigation work to be done in the particular exercise should be determined first. Then an itinerary should be selected on the map and the work distributed over the various stages of the route.

In the preparation of a dummy night flight, navigation work will include checking wind by drift angles, route check using radio navigation and illuminated landmarks, reaching the target at the designated time, and reaching the flight finishing point by homing on a radio station.

The first thing to do is to select the flight itinerary on a 1:500,000 map, plot the itinerary, and measure the distance and course angles. The flight itinerary includes the flight departure point -- an illuminated reference point, an illuminated turning point, a nonilluminated objective, a second turning point, and a radio station at the flight finishing point.

The dummy flight also includes the same navigation aids to which the air crew will have recourse when carrying out a flight -- the real call signs, wavelengths, etc.

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Over the first section of the route, position is determined from broadcasting station bearings and ground radio-direction finder. Calculations for reaching the target at the appointed time are made at the turning point. The course is calculated at the third stage. At the fourth, the position is determined by a bearing from a ground radio-direction finder.

To frame the actual problem, we fix the initial data: time for attacking target, 2300; true air speed, 400 km/hr; altitude, 2000 meters; wind, 200°, 50 km/hr.

From the time of attacking the target, the air speed and the wind, we determine the time at which the flight departure point is passed as 2225. Assuming that takeoff, rendezvous, and approach to the flight departure point takes about 10 minutes, takeoff time will be 2215. We select magnetic courses for measuring drift angles along the illuminated points up to the flight departure point: first magnetic course 20°, second magnetic course 120°, third magnetic course 60°. By setting up on the wind indicator the accepted true air speed, the wind and the magnetic courses, we find the corresponding values of the drift angles are 0°, +7°, and +5°.

Using the true air speed, altitude 2,000 meters and temperature +5°, the slide rule shows that instrument speed is 360 km/hr. Taking the instrument correction to the speed-indicator reading as +10 km/hr, we obtain an instrument reading of 350 km/hr. The quantities thus obtained -- magnetic courses, drift angles, instrument speed, altitude and temperature -- are incorporated in the problem. The wind velocity and direction are to be determined from this data.

The requirement for the next part of the problem is to calculate the compass course for the first leg of the flight and the time of arrival at the turning point. For the change of course, we give the deviation or refer to the deviation chart. The first step should be a visual check of the course by taking a bearing on the flight departure point and determining position by radio bearings for route check. The problem will therefore contain data on the measurement of the course angle of the flight departure point by sight. We require the determination of the actual track angle and the introduction of course correction. for example, at 2230 the flight departure-point course angle was measured and found to be 188°.

To obtain radio direction-finding data, we find the position of the aircraft at 2240 and determine for this point the direction of the broadcasting station. We then find the position of the aircraft at 2242 and determine the bearing of the ground radio direction finder for this point.

In the problem, we give the radio-compass reading, the radio deviation, compass deviation and bearing of the ground direction finder. It is required to find the position of the aircraft.

We further give the time of arrival at the turning point with a delay of one minute and require that a calculation be made for arrival over the target at the appointed time. Here it will be necessary to increase the ground speed to 500 km/hr. The air speed will be correspondingly increased and a correction must be made to the course steered (kurs sledovaniya). After this, we give the time of arrival at the target and data for bombing calculation.

On the third stage of the route it is required to calculate the course steered (kurs sledovaniya) and travel time (puteveye vremya). On the fourth stage, it is required to determine the position of the aircraft from the course and a bearing of the ground direction-finder station. We find the position of the aircraft at 2320 on the course (radiodrome) and determine the bearing, 30°.

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It then remains to give the time of reaching the radio station and the time of landing. The actual problem for the dummy flight may assume roughly the following form:

Dummy Flight Problem

Subject: "Night flight with arrival over target at given time."

1. Flight itinerary ...

Time of attack on target 2300. Date...

Ground aids to navigation: Light beacon at flight departure point, broadcasting station A, ground direction-finding station B, homing radio station at flight finishing point.

2. Time of takeoff - 2215.

3. Drift angles are computed en route to flight departure point. Magnetic courses 20°, 120°, 60°. Drift angles: 0°, +7°, +5°. Instrument air speed 350 km/hr, instrument correction +10 km/hr. Instrument altitude 2,000 meters. Temperature +5°.

Determine velocity and direction of wind.

4. Calculate the compass course for the first stage of the route. Compass deviation to be taken from the chart.

5. Flight departure point is passed at 2226, course as calculated. Calculate time of arrival at turning point.

6. At 2230 the course angle from departure point was measured and found to be 188°. Determine the actual track angle, calculate the course correction and correct the course steered.

7. At 2240, a bearing on broadcasting station A was taken and found to be 220°. Take radio deviation from the chart.

At 2242 a bearing of 20° was obtained from the ground direction-finding station. Calculate the position of the aircraft.

8. The turning point was reached at 2253. Make calculations to ensure arrival over the target at the time given. Air temperature at +6°. Instrument correction to the reading of the speed indicator + 20 km/hr.

9. Make calculations for bombing.

10. At target on time. Left target at 2303. Determine time of arrival at turning point.

11. Turning point reached as calculated. Flight finishing point is to be reached by homing on radio station.

12. At 2320 a bearing of 30° was obtained from the ground radio direction-finding station. Calculate position.

13. Flight finishing point was passed at 2334.

14. Landed at 2345.

After completing the dummy flight the students should present a log with all entries and calculations, and also a map with itinerary appended and marked to show the calculated positions.

When radio navigation methods are used during the dummy flight it should be checked to learn if the students are capable of tuning the radio compass, taking radio bearing, etc. All this work should be done on training apparatus.

It is especially necessary to emphasize that maximum utilization of training apparatus when working on dummy flights is a necessary condition for the successful preparation of flying personnel.

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